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GB-A- 111 811

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Description

The invention relates to an automatic injection device comprising an assembly of a discharge mechanism, a cartridge holder of a synthetic material and a cartridge which is slidably accommodated in the cartridge holder, which cartridge comprises a glass ampoule consisting of an ampoule cylinder in which an injection liquid or various injection liquids separated from each other by stoppers and a piston which can be moved in the ampoule cylinder are provided, a connection means for an injection needle in which or to which the injection needle is connected, and a shoulder between the ampoule cylinder and the needle connection means, the cartridge holder consisting of a sleeve-like rear portion, which is open at each end and which, after actuating the injection device, is traversed by the ampoule cylinder and the inner surface of which has substantially the same transverse dimensions over its whole length, and a front portion which forms one assembly with the sleeve-like portion and, after actuating the syringe, serves to discontinue the forward movement of the cartridge in the holder and to allow passage of the needle.

Such an injection device, namely for one injection liquid, is known from British Patent Specification 1,528,735. The device disclosed in said Patent Specification moreover comprises a spacer element with which the contents of the ampoule can be reduced at will, and a needle guard of a flexible material which keeps the needle sterile during storage of the device. Such a needle guard is an excellent provision and is preferably used also in the syringe according to the present invention.

An injector related to the injection device known from the above British Patent Specification is described in U.S. Patent Specification 3,712,301. In the species shown in figures 4 to 6 of this latter patent specification the cartridge holder is internally provided with three longitudinally extending ribs to distort the resilient sealing end portion of the ampoule during operation of the injector, thereby providing openings for flow of air in said end portion, and thus to allow the air locked in between the front of the cartridge holder and the front of the ampoule escaping backwards.

An automatic injection device as mentioned in the opening paragraph in which various injection liquids separated from each other by stoppers are accommodated is disclosed in European Patent Application No. 72057.

It has been found that when the injector known from the above British Patent Specification 1,528,735 or U.S. Patent Specification 3,712,301 is used, fracture of the glass ampoule often occurs, in particular when the ampoule is manufactured from unhardened glass. Upon actuating the device, apparently the material of the ampoule often cannot withstand the forces occuring upon relaxation of the spring forming part of the discharge mechanism. This disadvantage can be checked by using an ampoule around which a sheath of shrinkable plastic sheet has been shrunk, as described recently in European Patent Application No. 107874. The injection device according to the present invention preferably comprises a glass ampoule enveloped by a sheath of shrinkable sheet.

Automatic injection devices have been developed in particular for use by persons who have to administer an injection into their own body at a given instant which is not known beforehand. These persons include, for example, soldiers after having been exposed to a battle gas of the enemy, for example, a nerve gas. It should therefore be obvious that stringent requirements have to be imposed upon automatic injectors as regards their reliability. Such devices are usually stored for many years at a time and in addition are carried with the potential user for long periods of time under varying conditions. Despite these facts the reliability of the injector must remain sufficiently ensured at the critical instant when the injection is required. In fact, at said critical instant the user's life may depend on the ready operation of the injection device.

Automatic injection devices are exposed to heavy shocks in particular when used by soldiers in the fields. In order that in these circumstances the devices remain intact, i.e. still operate at the critical moment, high requirements must also be imposed upon the shock resistance of the injectors. It is therefore required, in particular by military authorities in various countries, that even extreme droptests do not adversely influence the ready operation of automatic injection devices. An example of a very extreme droptest is a test in which the automatic injector, without any further external protection means, falls from a height of 1.50 m on a granite table. It has been found that thereafter approximately 15% of the automatic injectors did no longer operate well even when the glass ampoule thereof was enveloped by a sheath of shrinkable sheet.

It is the object of the present invention to provide an automatic injection device which maintains its ready operation also under the above-described extreme conditions.

This object can be achieved by means of an automatic injection device of the type mentioned in the opening paragraph which, according to the invention, comprises a cartridge holder the sleeve-like portion of which, over a length which is at least equal to the length of the ampoule cylinder, has a five-sided to fourteen-sided cross-section and is proportioned in such way that the ampoule cylinder engages with friction the inner side surfaces of said sleeve-like portion.

It has surprisingly been found that when such a cartridge holder is used, not only the shock resistance of the automatic injection device is improved in such a manner that an ampoule of unhardened glass may be used without any objection, but also that the subtle cooperation between cartridge holder and ampoule is not adversely influenced. On the contrary, it has been found that upon actuating the injector according to the invention the ampoule cylinder can move forward even smoother and better centred in the cartridge

holder sleeve thus formed, while nevertheless the air in front of the ampoule can flow away backwards without any hindrance between the outer wall of the glass ampoule and the inner wall of the cartridge holder sleeve. Moreover, upon assembling the injection device according to the invention, positioning the cartridge in the cartridge holder is not hampered because of the flexibility of the plastic wall of the cartridge holder sleeve. The cartridge holder can be manufactured in a simple manner and hence cheaply, for example, by injection moulding, from a form-retaining slightly resilient synthetic material, for example, from polypropylene.

It has furthermore been found that also the rigidity of the cartridge holder of the injection device according to the invention is greater than that of a known cartridge holder, as described, for example, in the above-mentioned British Patent Specification 1,528,735; of course, this applies to equal wall thicknesses of the cartridge holders. As a result of this, the bending resistance of the injection device is increased so that an extra contribution is provided to the reliability of the device. When used under extreme conditions, for example by soldiers in the fields, the automatic injector may also be subjected to a large bending load, as a result of which the risk of fracture of the glass ampoule increases. An improvement of the bending resistance of the injection device hence is of great importance.

It has been found that the advantages of the syringe according to the invention appear in particular when the sleeve-like part of the cartridge holder has a six-sided to twelve-sided cross-section. A cartridge holder sleeve having a seven-sided cross-section has proved to be extremely suitable.

Without extra provisions on the inside of the cartridge holder sleeve, the possibility is not excluded that, when the injection device falls down on its front side or nose, the cartridge may slightly move forward in the cartridge holder sleeve. It may then occur that the needle emanates from the cartridge holder as a result of which the sterility of the needle is lost and, which is more serious, the tip of the needle is damaged. It has now been found that this risk can be avoided by providing at least three inner side surfaces of the sleeve-like portion of the cartridge holder of the injection device according to the invention with radially positioned raised portions which are distributed over the circumference of the sleeve-like portion and form one assembly therewith. During storage of the syringe these raised portions engage the ampoule shoulder or are positioned at a short distance in front of it. This provision which provides an extra contribution to the reliability of the injection device may be considered as a particular aspect of the invention because it can be used successfully only in a cartridge holder for an injection device according to the invention, i.e. a cartridge holder having a five-sided to fourteen-sided sleeve-like rear portion. As a matter of fact, the flat side walls in such a cartridge holder sleeve are so resilient that the raised portions thereon, provided their dimensions are suitable, can easily by pushed aside by the ampoule cylinder upon actuation of the syringe, so that the forward movement of the cartridge in the holder is not prevented or impeded in such menner that the injector no longer operates normally. On the other hand, the raised portions on the inner side surfaces of the cartridge holder sleeve are sufficient to prevent inedvertent movement of the ampoule within the holder, so to keep the cartridge in the cartridge holder in its place when the injector falls on its nose. Often all the inner side surfaces of the sleeve-like portion of the cartridge holder are provided with raised portions so that a seven-sided cartridge holder sleeve also comprises seven raised portions, but for the intended purpose fewer raised portions will suffice.

The above provisions to improve the shock resistance of an automatic injection device are intended in particular for an automatic injector the ampoule of which is manufactured from unhardened glass. If the glass has been subjected to a special hardening, the risk of fracture upon falling or impacting of the injector generally is comparatively small. However, as stated in the Europeen Patent Application 107874 mentioned hereinbefore such a hardening process is comparatively expensive and hence less attractive for automatic injectors which are manufactured in large quantities.

The invention furthermore relates to a cartridge holder for the injection device described hereinbefore, the sleeve-like portion of which has a five-sided to fourteen-sided cross-section over the whole or at least a part of its length.

The invention will now be described in greater detail with reference to preferred embodiments which are shown in the drawings, in which:

Figure 1 is a longitudinal sectional view of an injector according to the invention;

Figure 2 is a longitudinal sectional view of a cartridge holder as shown in Figure 1 but this time on a slightly larger scale;

Figure 3 is an enlargement of a detail of a longitudinal sectional view of the wall of the Figure 2 cartridge holder taken on the line III-III of Figure 2;

Figure 4 is a cross-sectional view of the cartridge holder shown in Figure 2 taken on the line IV-IV in Figure 2, viewed in the direction of the nose portion of the holder;

Figure 5 is an enlargement of a detail of the part of the cross-sectional view of Figure 4 indicated by V; and

Figure 6 is a cross-section view comparable to that of Figure 4 but of a different embodiment of the cartridge holder.

The injector shown in Figure 1 is in broad outline equal to that described and shown in the above-mentioned European Patent Application 107874. The embodiment shown in Figure 1 is only one example of an automatic injection device in which the provisions for improving the shock resistance can be

advantageously used. Other suitable examples of such injection devices are described end shown in European Patent Application 72057.

The injector shown in Figure 1 comprises an outer sleeve 1 having an inwardly bent edge 2 and circumferential groove 3, in which a cartridge assembly 4 and a discharge mechanism 5 are accommodated. The cartridge essembly comprises a cartridge holder 6 which fits in the outer sleeve and at its front end has a circular aperture 7, and a cartridge 8 which is movable in the cartridge holder. The cartridge comprises e ampoule 9 consisting of an ampoule cylinder 27, a neck 28, and a shoulder 29 between cylinder and neck. An injection needle 13 comprising a rubber needle guard 12 is connected on the neck of the ampoule by means of a needle holder 14. An injection liquid 10 is present in the ampoule between a piston 11 movable in the ampoule cylinder and e membrane 15 provided between the neck of the ampoule and the needle holder. Said membrane keeps the injection liquid seperated from the needle during storage of the injector, but bursts open during use of the syringe so that the injection liquid can reach the needle cannula. Furthermore, a spacer element 16 is provided behind the piston with which the volume of the ampoule for the injection liquid is reduced.

As the injector described in British Patent Specification 1,528,735, the discharge mechanism comprises an outer gun sleeve 17 locked in groove 3 of outer sleeve 1 and an inner gun sleeve 18 slidably accommodated in the outer gun sleeve and comprising a coil spring 19 as a power source. The coil spring fits around a plunger 20 with a sufficient amount of play, the plunger consisting of a plunger head which is inserted in the spacer element, a central portion 12 and an end portion 23. The end portion consists of four resilient prongs the conical ends 24 of which bear on a metal sealing ring 25 around an aperture in the rear face of the inner gun sleeve. In the Figure 1 syringe the safety member consisting of a cap with a safety pin which may extend between the prongs of the plunger, has already been removed so thet the syringe is ready for use. A sheath 26 of PVC shrinkable sheet is shrunk around the whole ampoule, including its neck and rear edge.

For further explanation, Figure 2 shows the cartridge holder 6 of Figure 1 on an enlarged scale. The cartridge holder consists of a tapering nose portion 30 which on its front comprises longitudinal ribs 31 for centering the needle guard 12. A circular aperture 7 is recessed in the front face of nose portion 30. The nose portion adjoins a sleeve-like rear portion 32 having increased transverse dimensions which are equal or substantially equal over the whole length. The shoulder 33 formed between the nose portion and the sleeve-like portion forms an abutment for the ampoule shoulder 29 in the position in which the cartridge is maximally moved forwards in the cartridge holder. As is shown clearly in the cross-sectional view of Figure 4, the sleeve-like rear portion of the cartridge holder has a seven-sided cross-section.

In the cross-sectional view of the cartridge holder shown in Figure 4 and viewed in the direction of the nose portion, the shoulder 33 formed by the nose portion of reduced diameter, the centering ribs 31 and the aperture in the front face of the nose portion are also shown. Seven radially positioned raised portions 34 which form one assembly with the cartridge holder wall are provided on the inner side surfaces of the sleeve-like rear portion of the cartridge holder. As is shown in Figure 1, said raised portions constitute an abutment for the ampoule shoulder 29; upon actuating the injector, however, the ampoule can easily be moved forwards, the raised portions positioned on the resilient side walls of the sleeve-like portion of the cartridge holder being pushed aside without any difficulty (overridden).

For further explanation, Figure 5 shows on en enlarged scale a detail of a wall part of the cartridge holder sleeve with two raised portions. Figure 3 furthermore shows on an enlarged scale a detail of a longitudinal sectional view of the cartridge holder wall taken on the line III-III of Figure 2. In Figure 3, *i* denotes en inner side surface and *o* denotes an outer side surface. Figure 6 finally is a cross-sectional view which is comparable to that of Figure 4, but this time through a cartridge holder having a twelve-sided rear portion. The reference numerals correspond to those of Figure 4.

The use of the injection device according to the invention is the same as that of the one described in British Patent Specification 1,528,735 mentioned hereinbefore and needs no further explanation.

Injection devices according to the invention in which the ampoule had been manufactured from unhardened glass around which a sheath of shrinkable sheet had been shrunk according to the above-mentioned European Patent Application 107874 and which had been provided with a cartridge holder having a seven-sided sleeve portion as described hereinbefore, were compared with identical injectors comprising a cartridge holder having a cylindrical sleeve portion internally provided with three longitudinal ribs (as described in the above US patent specification 3,712,301). The cartridge holders had been manufactured from polypropylene by injection moulding. The injectors to be tested were subjected to a droptest, either by dropping them flat on a granite table from a height of 1.50 metres (droptest A), or by dropping them six successive times from a height of 1.20 metres on a concrete floor (droptest B). The injectors were then "discharged". The following results were obtained:

injector: cartridge holder sleeve	injector: glass ampoule	droptest	number of tested injectors	well expelled: number	well expelled: %
seven-sided	unhardened	A	50	49	98
seven-sided	do.	B	50	50	100
cylindrical	do.	A	50	43	86

"Well expelled" is to be understood to mean that upon "discharge" of the injector, the injection liquid has left the injector through the injection needle and has not prematurely leaked away from the ampoule due to fracture thereof.

From the above results it appears that when a cartridge holder sleeve having a plurality of flat sides is used instead of a cylindrical one, the percentage of fracture of the ampoules in droptests of automatic injection devices can be reduced to an acceptable percentage.

Claims

1. An automatic injection device comprising an assembly of a discharge mechanism (5), a cartridge holder (6) of a synthetic material and a cartridge (8) which is slidably accommodated in the cartridge holder, which cartridge comprises a glass ampoule (9), if desired enveloped by a sheath of shrinkable sheet, said ampoule consisting of an ampoule cylinder (27) in which an injection liquid (10) or various injection liquids separated from each other by stoppers and a piston (11) which can be moved in the ampoule cylinder are provided, a connection means (14) for an injection needle (13) in which or to which the injection needle (13), if desired, covered by a guard (12) to maintain the needle in a sterile condition, is connected, and a shoulder (29) between the ampoule cylinder and the needle connection means, the cartridge holder consisting of a sleeve-like rear portion (32) which is open at each end and which, after actuating the injection device, is traversed by the ampoule cylinder and the inner surface of which has substantially the same transverse dimensions over its whole length, and a front portion (30) which forms one assembly with the sleeve-like portion and, after actuating the syringe, serves to discontinue the forward movement of the cartridge in the holder and to allow passage of the needle, characterized in that the sleeve-like portion of the cartridge holder has a five-sided to fourteen-sided cross-section over a length which is at least equal to the length of the ampoule cylinder and is proportioned in such way that the ampoule cylinder engages the inner side surfaces of said sleeve-like portion with friction.

2. An injection device as claimed in claim 1, characterized in that the sleeve-like portion of the cartridge holder has a six-sided to twelve-sided, preferably a seven-sided, cross-section.

3. An injection device as claimed in claim 1 or 2, characterized in that at least three inner side surfaces of the sleeve-like portion of the cartridge holder comprise radially positioned raised portions (34) distributed over the circumference of the sleeve-like portion and forming one assembly therewith, which raised portions, during storage of the syringe, engage the ampoule shoulder or are positioned at a short distance in front of it, but which portions have such dimensions that upon actuating the syringe they are pushed aside by the ampoule cylinder so that the forward movement of the cartridge in the holder is not hampered.

4. An injection device as claimed in any of the preceding claims, characterized in that the ampoule is manufactured from unhardened glass.

5. A cartridge holder for an injection device as claimed in any of the preceding claims, consisting of a sleeve-like rear portion (32) which is open at each end and the inner surface of which has substantially the same transverse dimensions over its whole length, and a front portion (30) which forms one assembly with the sleeve-like portion and which comprises means to discontinue the forward movement of the cartridge in the holder after actuating the syringe and to allow passage of the needle, characterized in that the sleeve-like portion has a five-sided to fourteen-sided cross-section over the whole or at least a part of its length.

6. A cartridge holder as claimed in claim 5, characterized in that at least three inner side surfaces of the sleeve-like portion comprise radially positioned raised portions (34) distributed over the circumference of the sleeve-like portion and forming one assembly therewith.

Patentansprüche

1. Automatische Injektionsvorrichtung mit einem Abgabemechanismus (5), einem Patronenhalter (6) aus synthetischem Material und einer im Patronenhalter verschiebbar aufgenommenen Patrone (8) in einer Baugruppe, welche Patrone eine Glasampulle (9), gewünschtenfalls von einer Schrumpffolienhülle umgeben, umfaßt, wobei die Ampulle aus einem Ampullenzylinder (27), in dem eine Injektionsflüssigkeit (10) oder verschiedene, voneinander durch Absperrorgane getrennte Injektionsflüssigkeiten und ein im Ampullenzylinder bewegbarer Kolben (11) vorgesehen sind, einer Verbindungseinrichtung (14) für eine Injektionsnadel (13), in der bzw. an der die Injektuionsnadel (13), falls gewünscht umgeben von einem Schutz (12), um die Nadel in einem sterilen Zustand zu halten, angeschlossen ist, und einer Schulter (29) zwischen dem Ampullenzylinder und der Nadelverbindungseinrichtung besteht, wobei der Patronenhalter aus einem hülsenartigen hinteren Teil (32), der an jedem Ende offen ist und nach Betätigung der Injektionsvorrichtung vom Ampullenzylinder durchquert wird, und dessen Innenfläche im wesentlichen die selben Querabmessungen über seine ganze Länge hat, und aus einem vorderen Teil (30) besteht, der eine Baueinheit mit dem hülsenartigen Teil bildet und nach Betätigung der Injektionsspritze dazu dient, die Vorwärtsbewegung der Patrone im Halter anzuhalten und den Durchgang der Nadel zu ermöglichen, dadurch gekennzeichnet, daß der hülsenartige Teil des Patronenhalters einen fünf- bis viehrzehnseitigen Querschnitt über eine Länge zumindest gleich der Länge des Ampullenzylinders hat und so proportioniert ist, daß der Ampullenzylinder mit den Innenseitenflächen des hülsenartigen Teiles in Reibungseingriff steht.

2. Injektionsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der hülsenartige Teil des Patronenhalters einen sechs- bis zwölfseitigen, vorzugsweise einen siebenseitigen, Querschnitt hat.

3. Injektionsvorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß zumindest drei Innenseitenflächen des hülsenartigen Teiles des Patronenhalters radial angeordnete erhabene Teile (34) aufweisen, die über den Umfang des hülsenartigen Teiles verteilt sind und eine Baueinheit damit bilden, wobei die erhabenen Teile während der Lagerung der Injektionsspritze in Eingriff mit der Ampullenschulter stehen oder ein kurzes Stück vor ihr angeordnet sind, jedoch solche Abmessungen haben, daß sie bei Betätigen der Injektionsspritze vom Ampullenzylinder zur Seite gedrückt werden, so daß die Vorwärtsbewegung der Patrone im Halter nicht gehemmt wird.

4. Injektionsvorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Ampulle aus ungehärtetem Glas hergestellt ist.

5. Patronenhalter für eine Injektionsvorrichtung nach einem der vorhergehenden Ansprüche, bestehend aus einem hülsenartigen hinteren Teil (32), der an jedem Ende offen ist und dessen Innenfläche im wesentlichen die selben Querabmessungen über seine ganze Länge hat, und aus einem vorderen Teil (30), der eine Baueinheit mit dem hülsenartigen Teil bildet und Mittel umfaßt, um nach Betätigung der Injektionsspritze die Vorwärtsbewegung der Patrone im Halter anzuhalten und den Durchgang der Nadel zu ermöglichen, dadurch gekennzeichnet, daß der hülsenartige Teil des Patronenhalters einen fünf- bis viehrzehnseitigen Querschnitt über die ganze oder zumindest einen Teil seiner Länge hat.

6. Patronenhalter nach Anspruch 5, dadurch gekennzeichnet, daß zumindest drei Innenseitenflächen des hülsenartigen Teiles des Patronenhalters radial angeordnete erhabene Teile (34) aufweisen, die über den Umfang des hülsenartigen Teiles verteilt sind und eine Baueinheit damit bilden.

Revendications

1. Dispositif d'injection automatique comprenant un ensemble de mécanisme de décharge (5), un porte-cartouche (6) en un matériau synthétique et une cartouche (8) qui est logée dans le porte-cartouche en pouvant y coulisser, cartouche qui comprend une ampoule en verre (9), enveloppée si on le souhaite dans une gaine de feuille rétractable, ladite ampoule consistant en un cylindre d'ampoule (27) dans lequel sont contenus un liquide d'injection (10) ou divers liquides d'injection séparés l'un de l'autre par des pièces d'arrêt et un piston (11) qui peut être déplacé dans le cylindre d'ampoule, un moyen de liaison (14) destiné à une aiguille d'injection (13) dans lequel ou auquel est reliée l'aiguille d'injection (13), couverte si on le souhaite par un protège-aiguille (12) pour maintenir l'aiguille en condition stérile, et un épaulement (29) entre le cylindre d'ampoule et le moyen de liaison de l'aiguille, le porte-cartouche consistant en une partie arrière en forme de manchon (32) qui est ouverte à chaque extrémité et qui, après l'actionnement du dispositif d'injection, est traversée par le cylindre d'ampoule et dont la surface intérieure a sensiblement les mêmes dimensions transversales sur toute sa longueur, et en une partie avant (30) qui constitue un ensemble avec la partie en forme de manchon et qui, après l'actionnement de la seringue, sert à interrompre le mouvement avant de la cartouche dans le porte-cartouche et à permettre le passage de l'aiguille, caractérisé en ce que la partie en forme de manchon du porte-cartouche présente une section transversale comportant de cinq à quatorze pans sur une longueur qui est au moins égale à la longueur du cylindre d'ampoule et qui est proportionnee de telle façon que le cylindre d'ampoule soit en contact de frottement avec les surfaces du côté intérieur de cette partie en forme de manchon.

2. Dispositif d'Injection suivant la revendication 1, caractérisé en ce que la partie en forme de manchon du porte-cartouche présente une section transversale comportant de six à douze pans, de préférence sept pans.

3. Dispositif d'injection suivant la revendication 1 ou 2, caractérisé en ce qu'au moins trois surfaces du côté intérieur de la partie en forme de manchon du porte-cartouche comprennent des parties surélevées (34) disposées radialement, réparties sur la circonférence de la partie en forme de manchon et constituant un ensemble avec celle-ci, parties surélevées qui, pendant le stockage de la seringue, sont en contact avec l'épaulement de l'ampoule ou sont disposées à une faible distance à l'avant de celle-ci, mais qui présentent des dimensions telles que lors de l'actionnement de la seringue elles sont écartées par le cylindre d'ampoule de sorte que le mouvement avant de la cartouche dans le porte-cartouche n'est pas gêné.

4. Dispositif d'injection suivant l'une quelconque des revendications précédentes, caractérisé en ce que l'ampoule est réalisée en verre non-durci.

5. Porte-cartouche pour dispositif d'injection suivant l'une quelconque des revendications précédentes, consistant en une partie arrière en forme de manchon (32) qui est ouverte à chaque extrémité et dont la surface intérieure a sensiblement les mêmes dimensions transversales sur toute sa longueur, et en une partie avant (30) qui constitue un ensemble avec la partie en forme de manchon et qui comprend des moyens pour interrompre le mouvement avant de la cartouche dans le porte-cartouche après l'actionnement de la seringue et de permettre le passage de l'aiguille, caractérisé en ce que la partie en forme de manchon présente une section transversale comportant de cinq à quatorze pans sur toute sa longueur ou au moins sur une partie de celle-ci.

6. Porte-cartouche suivant la revendication 5, caractérisé en ce qu'au moins trois surfaces du côté intérieur de la partie en forme de manchon comprennent des parties surélevées (34) réparties sur la circonférence de la partie en forme de manchon et constituant un ensemble avec celle-ci.

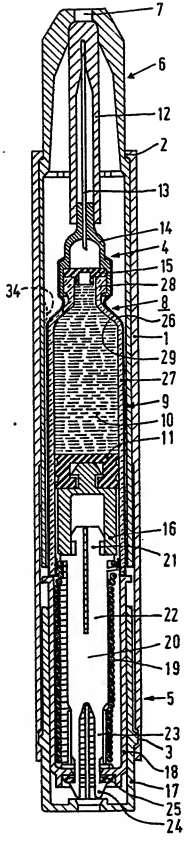
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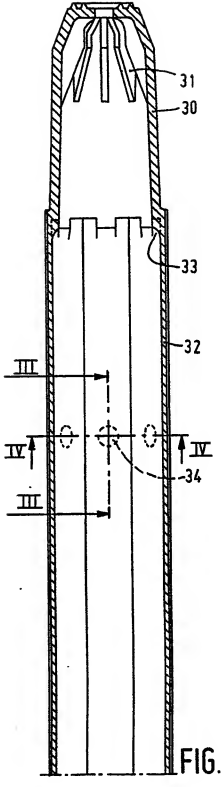
FIG.1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III
IV
IV
34
III

FIG.2

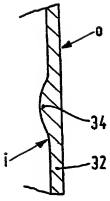

FIG. 3

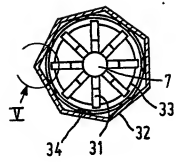

FIG. 4

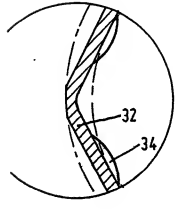

FIG. 5

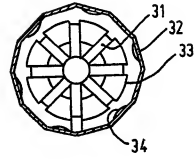

FIG. 6